

NESTING SUCCESS OF EGRETS AND HERONS IN GEORGIA

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IN 1955 while living on Sapelo Island, Georgia, I had the opportunity to undertake a study of the nesting success of the Common Egret (*Casmerodius alba*), Snowy Egret (*Leucophoyx thula*), Louisiana Heron (*Hydranassa tricolor*), Black-crowned Night Heron (*Nycticorax nycticorax*), and White Ibis (*Eudocimus alba*), all of which nested during the summer on and around an artificial duckpond on the north end of the island.

The heronry consists of a number of small islets in the middle of a pond which had only a small amount of open water, the rest being filled with cattails and other marsh plants. The nests were built on trees growing close to the edge of the water on these islands. There was no choice of particular plant species in which to build a nest. Trees (both pines and hardwoods), shrubs, vines, and even matted tangles of herbs, vines, and brambles were used as nest sites.

The study was begun in the middle of April, as soon as the birds began to construct their nests, and was continued until September, when most of the nesting activity had ceased. The heronry was visited by canoe once a week early in the morning. Four islets were selected for study. At the start of the work every nest built on these islets was followed until it was either destroyed or the young birds left. Later in the season many nests on the largest islet were left unstudied for lack of time. White Ibis began to nest last and thus only a small percentage of their nests were followed. Each study nest was marked with paint on a nearby branch for identification. The eggs were counted and weighed and the young when they hatched were counted and weighed, and finally banded. Thanks are due to Herbert W. Kale II for assistance.

RESULTS

Common Egret.—The Common Egret began to nest around the first of April, and 43 nests were marked and followed to the successful fledging of young or destruction of the nest. A rather large number of these nests, eight of 43, were destroyed before any eggs were laid. This resulted both from the insecure nest sites often chosen by this rather large, heavy bird, and the destruction of nests by animals searching for eggs. A large number of the nests that were destroyed after laying had been completed (but before hatching) were on one islet which was invaded by raccoons. In contrast to other areas, the nests which had been destroyed on this islet were not rebuilt. There were four nests in which the completed clutch consisted of two eggs.

22 nests with three eggs, and four nests with five eggs. The food of the young Common Egrets, determined from material ejected when the young were handled, consisted mainly of small fish of species found in salt marshes and estuaries. *Fundulus* and small menhaden were identified. The young began to leave the nest and could not be studied further 2 to 3 weeks after they hatched, when they began to wander into the swampy areas. They were unable to fly for some time after they left the nest, but I have no exact data on the duration of this period.

Snowy Egret.—Although about 10 per cent of the Snowy Egrets began to nest at the beginning of April, the majority (68 per cent) did not begin until June. There were four nests with two eggs, 15 with three, nine with four, and one with five. The observed food of the young was similar to that of the Common Egret, although the fish involved were smaller. On the fourth visit after hatching, the young readily left the nest upon the approach of the observer and although they returned to the nest after the disturbance their history could not be followed from that time on.

A “blushing” reaction similar to that reported for the European Heron (Lowe, 1954) and for the Black-crowned Night Heron (Noble, Wurm, and Schmidt, 1938) was observed in this species. The lores of the birds assumed a bright red-orange color which subsequently faded to the normal yellow. Blushing was associated with nest building and display.

Louisiana Heron.—Out of 15 nests of Louisiana Heron that were studied, one had two eggs as its full clutch, 11 three eggs, and three had four eggs. The nests were begun in May and June. Three weeks after hatching, the young had begun to leave the nest. The Louisiana Heron young are particularly active and expert in climbing and left their nest at the observer's approach 1 week sooner than the young Snowys. They do not go far, however, and could easily be associated with the proper nest until the fourth visit.

Black-crowned Night Heron.—Black-crowned Night Herons began to nest at about the same time as the other herons, in May and June. It was possible to follow only eight nests, partly because the species was not very common in the heronry, and partly because on the large islet many nests were built high in the trees. All the nests contained three eggs. As young, Black-crowns are easily the most pugnacious of the herons. When the observer approached the nest, they vomited and defecated with considerably more fervor than the other species. They also defended their nest vigorously, first by squawking with their wings outstretched and their beak wide open, making thrusting motions as though to defecate or vomit, even though they were by that time empty, also by making vigorous thrusts with the bill closed and used as a stabbing weapon. A small bird, 300 to 400 grams, commonly vomited fish between 6 and 9 inches long. Besides the fish, night herons on several oc-

TABLE 1
SUCCESS OF HERON NESTING BY NESTS, SAPELO ISLAND, GEORGIA, 1958

	Common Egret	Snowy Egret	Louisiana Heron	Black-crowned Night Heron	White Ibis
Nests studied	43	30	15	8	14
Destroyed					
Before laying	8	0	0	0	0
Before full clutch	4	1	0	0	0
Before hatching	12	7	2	0	8
After hatching	2	11	6	1	1
Successful	17	11	7	7	5
Nests with eggs:					
per cent success	49%	37%	47%	87%	36%
Nests without loss	11	2	2	3	3
Approximate number nests in colony	85	100	40	60	1,000

casions had fed on young birds. Three young White Ibis and one Snowy Egret, weighing about 100 grams each, were vomited by four different young night herons. Night heron young will leave their nest when disturbed at about 3 weeks after hatching, but they seem less inclined to leave than the other species, probably due to their more vigorous defense of themselves.

White Ibis.—During an ordinary year, only a few White Ibis have nested on Sapelo, but in the summer of 1958 approximately 1,000 nests were counted. A note from Robert P. Allen said that the Drum Island ibis colony in Charleston Harbor, South Carolina, had only four pairs in 1958, but some 3,000 pairs in 1959. Some of these may have been the birds which nested on Sapelo in 1958. A few ibis began nesting in the middle part of June, but most nests were begun around the first of July. Of the study nests, six had two eggs and eight had three. At hatching the eyes of young ibis, unlike those of herons, were closed. Their eggs weighed about 40 grams, and the young were approximately twice this size before the eyes opened, if they were growing normally. The young are excellent climbers and, from 2 to 3 weeks after hatching, left the nest on a slight provocation as soon as they were able. It was quite common to see great masses of young ibis clustered in the tops of trees where they had climbed from the nests which were distributed from the lowest branches upward. The food of the White Ibis young was almost exclusively shrimp (*Palaemonetes*), caught in the salt marshes.

EGG AND YOUNG SURVIVAL

Table 1 shows a summary of the success of the heron nesting by nests. The Black-crowned Night Heron was the most successful, which is undoubtedly

related to its pugnacious behavior. The differences between results for the night heron and those for all but the Louisiana are significant at the $P = 0.05$ level. In the unsuccessful nest, the young had been abandoned and died of exposure and starvation. Whether the adults were killed or abandoned the young for some other reason is unknown. The Common Egret was successful in about half of the nests, and most of those that were destroyed were lost before the young were hatched. While the eggs and young are on the nests unattended by adults, there are considerable periods when a predator could easily and safely steal eggs. Since the nests of this large heron are usually placed to allow an unobstructed landing, the eggs are readily visible from the air. However, once the young hatch and begin to grow, their size alone helps to protect them against predation. The Louisiana Heron also was successful in nearly half of the nests, though here the failures were more common after hatching than before. The nests of this species are better concealed, and possibly the movement of newly hatched chicks attracts more attention than eggs resting in a nest. For the Snowy Egret and the White Ibis, only slightly more than one-third of the nests were successful. Around one-quarter of those of the nests of the Common Egret and the Black-crowned Night Heron sustained no loss at all, while only a small portion of the nests of the other species were without loss of either eggs or young.

Table 2 gives a summary of the success of the nests by eggs and young. The number of eggs that failed to hatch was quite low: 2 to 3 per cent for the egrets, but around 10 per cent for the other species. Knabe (*in* Lowe, 1954) found that 3 per cent of the eggs of the Gray Heron in East Prussia failed to hatch. A 10 per cent infertility would seem an unnecessarily high wastage of the birds' reproductive effort. It is possible that part of this failure to hatch in the late June and July nests is caused by the hot sun, and resultant death of embryos, while the adults are off the nests, rather than by infertility. One instance on a clear day in July was noted (not included in Table 2) in which the desertion of the nest for about 30 minutes around 10 AM resulted in the death of pipping White Ibis eggs, but young already hatched were unharmed. This occurred after most of the eggs included in this study had hatched. The regular visits to the nests were timed so that the eggs were exposed only for a few minutes early in the day. If undisturbed by predators at least some eggs in all study nests hatched. All of the species, except the Black-crowned Night Heron for which the sample is small, lost an appreciable proportion of their eggs as a result of predation, mostly by raccoons and crows.

Losses of the young after hatching are also listed in Table 2. The one nest of Black-crowned Night Herons in which all three young starved is listed under "unknown." In all other cases the young which starved had hatched last.

TABLE 2
SUCCESS OF HERON NESTING BY EGGS AND YOUNG, SAPELO ISLAND, GEORGIA, 1958

	Common Egret	Snowy Egret	Louisiana Heron	Black-crowned Night Heron	White Ibis
Number eggs	99	96	47	24	36
Losses					
Failure to hatch	3%	2%	8%	8%	11%
Predation	44%	33%	19%	0%	50%
Number hatched	52	62	34	22	14
Losses					
Starvation	2%	10%	9%	—	7%
Predation	11%	39%	32%	—	21%
Accident	—	3%	—	14%	—
Unknown	2%	10%	16%	9%	—
Number fledged	44	24	15	17	10
Per cent of hatched	85%	42%	44%	77%	71%
Per cent of eggs	44%	27%	32%	71%	28%

Lack (1954) believes that the clutch size for most birds represents the largest number of young that the parents can feed. The habit of beginning incubation before the final clutch size is achieved assures that young which hatch first will receive most of the food and be successfully fledged, while the later hatchlings represent a sort of reserve growth potential, and will be raised only if there is sufficient food supply. If this theory is correct, there ought to be in any one year, a higher proportion of young starving in nests with four eggs than in nests with three eggs. In the present study, there were 41 successful three-egg nests; in seven of these (17 per cent) one young bird starved. There were seven successful four-egg nests; in three of these (43 per cent) one or more young starved. This difference just misses being statistically significant, due to the small number of four-egg nests found.

Predation as a cause of loss of young is less important in the larger and fiercer birds than in the smaller. There was no loss of young by predation among the 22 Black-crowned Night Heron young, and only 11 per cent among the 50-odd Common Egrets, while the other species' losses varied from 20 to 40 per cent.

Accidental death could be established only if the bird remained next to the nest after the accident. In case of accidents reported in Table 2, the young birds (dead from starvation or strangulation and exposure), were found caught in a crotch of a tree next to their nests. It is possible that part of the unknown category is the result of the approach of the observer to the nest at the stage when the young were active. Young, subsequently unable to find their way back to the nest, would perish.

Aside from the Black-crowned Night Herons, none of the birds succeeded in raising as many as 50 per cent of their eggs to fledged birds, although the Common Egret, presumably because of its size and therefore success in defending its nest, succeeded in raising 85 per cent of the eggs that were hatched. The White Ibis was also very successful in this regard, raising slightly more than 70 per cent of the eggs that hatched, while the two small heron species raised only a little more than 40 per cent of the eggs hatched. The number of young fledged divided by the number of eggs varied from 27 to 44 per cent, with the exception of the Black-crowned Night Heron, which managed to fledge 71 per cent of the eggs that were laid. This is as high as any figures reported by Nice (1957) for altricial birds, for which she found an average fledging success, as per cent of eggs, to be 46 per cent.

In all of my data there is a bias, introduced by visiting the nests. Although the extent of this bias is not known, there are a few observations related to it. I never saw raccoons on or about the heronry pond during the daylight but saw them in the vicinity in the evening. We never disturbed the birds in the evening as all our visits to the islets were in the early morning, and predation by raccoons was probably not greatly influenced by our visits. Predation by other birds was probably not greatly affected either, since they also stayed away while we were on the islet and the herons and ibis frightened from their nests as we came up to the islets returned as soon as we were a few canoe lengths away again.

The bias resulting from frightening the young birds is greater and is difficult to assess. It is quite certain that 3 to 4 weeks after hatching the young leave their nests to some extent on their own initiative, or at least as the results of causes that had nothing to do with these observations. On several occasions young were observed several feet from their nests before they had had time to go that far as a result of our presence. These birds had been banded and were resting quietly in their nests when left the week before. Certainly, however, human disturbance caused young to leave earlier and to go farther than they would otherwise have done.

A rough calculation of the amount of food needed to support the heronry can be made and compared with the food available (see Teal, 1962, for further discussion). There were about 2,000 breeding pairs and a total of 5,000 birds present in the heronries. With a respiratory rate of 1 liter O_2 /hr (Zeuthen, 1953), the birds would have required 210×10^6 kilocalorie/year. On the basis of observed nesting success the young would require about 36×10^6 kcal to live and grow. The population is assumed to be stable, i.e., a number of birds equal to the number fledged dies each year. This indicates that about 250×10^6 kcal/year are needed to support this heronry. There are 275 sq km of marsh on which these birds feed resulting in a drain of

less than 1 kcal/m²/year. Although the birds feed on shrimps and fish, these animals in turn derive their food ultimately from the marsh (Teal, 1962).

One kcal/m²/year is only a small fraction of the marsh production suitable for food for these birds, and we may conclude that considerably more wading-bird food is produced than they use. This remains true even if the estimate of energy required by the birds is twice too small or too large. Nevertheless that food is limiting in some ways, as indicated by the fact that up to 10 per cent of nestlings starved during this particular summer. The conclusion is not that there is insufficient food to support a greater population of birds, but that food is not sufficiently available to the adults for them to raise a larger number of young. It is suggested that wading birds feeding on salt marshes are, like many other predators, relatively inefficient food gatherers and are able to take only the more easily available individuals among their prey.

SUMMARY

A study of the nesting success of Common Egrets, Snowy Egrets, Louisiana Herons, Black-crowned Night Herons, and White Ibis was made on a marshy pond on Sapelo Island, Georgia. The nests were visited once a week, and eggs and young counted and weighed. Losses were mainly in the egg stage in the Common Egret and ibis and in the nestling stage in the Snowy Egret and Louisiana Heron. Losses of the night heron were small in both stages. Losses from starvation were more common in four-egg than three-egg clutches. A calculation of energy requirements indicates that although food is limited, as witnessed by starvation of nestlings, the birds use only a portion of the marsh production of suitable prey.

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